

WHAT IS CLAIMED IS:

1. An apparatus for separating a mixture of a less dense fluid, a more dense fluid, and fines, the less and more dense fluids being immiscible with each other, the apparatus comprising:

5 a housing having an inlet at an upstream end thereof and an outlet at a downstream end thereof;

a separation chamber located within the housing between the inlet and the outlet, the separation chamber comprising:

a generally horizontal enclosure; and,

10 a screw defining a helical passage through the enclosure,

the separation chamber having at least one upper aperture located in an upper portion of the helical passage and at least one lower aperture located in a lower portion of the helical passage; and,

15 a baffle attached between the housing and the separation chamber for directing at least a portion of the mixture into the separation chamber,

whereby as the mixture is directed through the helical passage at least a portion of the less dense fluid passes through the at least one upper

20 aperture into an upper collection zone in the housing, and at least a portion of the fines passes through the at least one lower aperture into a lower collection zone in the housing.

2. An apparatus according to claim 1 comprising a distribution
25 chamber coupled to the inlet, the distribution chamber comprising a coalescing plates pack for directing at least a portion of the less dense

fluid to the upper collection zone and at least a portion of the fines to the lower collection zone.

3. An apparatus according to claim 2 wherein the coalescing plates
5 pack comprises a plurality of corrugated plates inclined at an angle in the range of 45 to 75 degrees to the horizontal, with their corrugations oriented so as to cross a direction of flow through the coalescing plates pack.
- 10 4. An apparatus according to claim 2 wherein the distribution chamber has a cross-sectional area greater than a cross-sectional area of the inlet, such that a velocity of the mixture is reduced as the mixture passes from the inlet to the distribution chamber.
- 15 5. An apparatus according to claim 1 wherein the separation chamber comprises a coalescing chamber in fluid communication with the helical passage and located at a downstream end thereof, the coalescing chamber containing a plurality of beads which attract small droplets of the less dense fluid and form larger droplets of the less dense fluid.
- 20 6. An apparatus according to claim 5 wherein the coalescing chamber comprises a perforated plate at each of an upstream and a downstream end thereof, the perforated plates having perforations sized to retain the beads in the coalescing chamber and allow the mixture to pass
25 therethrough.

7. An apparatus according to claim 6 wherein the separation chamber comprises a second screw located downstream of the coalescing chamber defining a second helical passage, the separation chamber having at least one second upper aperture located in an upper portion of the second helical passage and at least one second lower aperture located in a lower portion of the second helical passage.
8. An apparatus according to claim 7 wherein the separation chamber comprises a second coalescing chamber in fluid communication with the second helical passage and located at a downstream end thereof, the second coalescing chamber containing a plurality of beads which attract small droplets of the less dense fluid and form larger droplets of the less dense fluid.
9. An apparatus according to claim 8 wherein the second coalescing chamber comprises a perforated plate at each of an upstream and a downstream end thereof, the perforated plates having perforations sized to retain the beads in the second coalescing chamber and allow the mixture to pass therethrough.
10. An apparatus according to claim 1 comprising a heater located in the housing.
11. An apparatus according to claim 10 wherein the heater comprises a helical heating coil positioned around the separation chamber.

12. An apparatus according to claim 1 wherein the generally horizontal enclosure comprises a cylinder.
13. An apparatus according to claim 1 comprising a conduit located in
5 an upper portion of the housing for removing the less dense fluid from the upper collection zone.
14. An apparatus according to claim 1 comprising a fines outlet conduit located in a lower portion of the housing for removing the fines
10 from the lower collection zone.
15. An apparatus according to claim 1 comprising a gas collection cylinder attached to a top of the housing for collecting gas introduced into the housing along with the mixture.
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16. An apparatus according to claim 15 comprising a gas outlet conduit located in an upper portion of the gas collection cylinder for removing gas from the gas collection cylinder.
- 20 17. An apparatus according to claim 1 comprising a polishing chamber defined by between a downstream end plate of the housing and a baffle attached to a downstream end of the separation chamber.
18. An apparatus according to claim 17 wherein the downstream end
25 plate of the housing comprises an aperture therein sized to allow the separation chamber to be removed from the housing, the apparatus

comprising a lid removably attached to the downstream end plate for covering the aperture therein, wherein the outlet is located on the lid.

19. An apparatus according to claim 18 wherein the polishing chamber
5 comprises a polishing device coupled to the inside of the lid, the polishing device comprising:

a polishing cylinder having an aperture in a lower portion thereof for admitting the mixture into the polishing device;

10 a first coalescing zone in the polishing cylinder having fine beads therein, the first coalescing zone defined between a first perforated plate located adjacent to the aperture of the polishing cylinder and a second perforated plate located above the first perforated plate;

15 a second coalescing zone in the polishing cylinder having coarse beads therein, the second coalescing zone defined between the second perforated plate and a third perforated plate located above the second perforated plate;

a less dense fluid collecting zone defined between the third perforated plate and an upper wall of the polishing cylinder;

20 a less dense fluid evacuation conduit for removing the less dense fluid from the less dense fluid collecting zone; and,

a plate extending downwardly and outwardly from the lid for directing the more dense fluid away from the less dense fluid evacuation conduit and toward the outlet.

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